

Notice of Allowability

Application No.

10/729,838

Examiner

Gordon J. Stock

Applicant(s)

MIEHER ET AL.

Art Unit

2877

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment received 7/27/07.
2. ☒ The allowed claim(s) is/are 1-9,34,35,40-42,46,47,57-64,89,90,95-97 and 101.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____ |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input checked="" type="checkbox"/> Other <u>PTOL-413B</u> . |

DETAILED ACTION

1. The Amendment received on July 27, 2007 has been entered into the record.

EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Attorney Mary Olynick on July 31, 2007. Specifically, previously withdrawn **claims 43-45, 51, 52, 98-100** will be cancelled. Figs. 11d-11f received on February 26, 2007 will not be entered, for it is a replacement sheet for application 10/785,731. See attached copy of Figs. 11d-11f. In addition, the amendment to the specification received on February 26, 2007 have replacement paragraphs for application 10/785,731. All replacement paragraphs will be deleted except for paragraph of page 74 line 3 which will be corrected below. And replacement paragraphs at page 42, line 3 and page 79, line 6 should actually be replacement paragraphs located on page 30 line 6 and page 60 line 19 respectively. See attached PTOL-413B. Also Examiner has amended **claim 47** because of a misplaced period on line 20 which should be a comma ('overlay error.' should read -overlay error,-)

Amendment to the claims:

Claims 43-45 (cancelled)

Art Unit: 2877

Claim 47 (currently amended) A method for determining overlay error between a plurality of first structures in a first layer of a sample and a plurality of second structures in a second layer of the sample, the method comprising:

providing targets A, B, C, and D that each include a portion of the first and second structures,

wherein the target A is designed to have an offset X_a between its first and second structures' portions,

wherein the target B is designed to have an offset X_b between its first and second structures' portions,

wherein the target C is designed to have an offset X_c between its first and second structures' portions,

wherein the target D is designed to have an offset X_d between its first and second structures' portions,

wherein each of the offsets X_a , X_b , X_c , and X_d is different from zero, X_a is an opposite sign and differs from X_b , and X_c is an opposite sign and differs from X_d ;

Art Unit: 2877

illuminating the targets A, B, C, and D with electromagnetic radiation to obtain spectra S_A , S_B , S_C , and S_D from targets A, B, C, and D, respectively; and

determining and storing any overlay error between the first structures and the second structures using a scatterometry technique based on the obtained spectra S_A , S_B , S_C , and S_D , and without using calibration or modeling data to determine any overlay error[.],

wherein obtaining the spectra S_A , S_B , S_C , and S_D comprises acquiring radiation from the targets A, B, C, and D using an imaging spectroscopic ellipsometer, and

wherein an illumination and imaging NA's of the imaging spectroscopic ellipsometer are chosen to optimize the performance of the instrument on scattering structures by ensuring that only the zeroth diffraction order is collected.

Claims 51-52 (cancelled)

Claims 98-100 (cancelled)

Amendment to the drawings:

Figs. 11d-11f (received on February 26, 2007) is subsequently not entered. See attached copy.

Amendments to the specification:

Please replace the paragraph beginning at page 30, line 6 with the following paragraph:

The system of 530 of Figure 5b is similar to the system 500 of Figure 5A, except a wavelength modulation device 532 is used in place of a wavelength selection device. The system 540 of Figure 5C is similar to the system 500 of Figure 5A, except the wavelength selection device 542 is positioned in the output beam path. The system 550 of Figure 5D is similar to the system 500 of Figure 5C, except a wavelength modulation device ~~[[532]]~~ 552 is used in place of a wavelength selection device. The wavelength modulation device operates by modulating the intensity of different wavelengths in different temporal patterns such as different sinusoidal frequencies. The most common examples of such a device are interferometers which can be controlled by changing one or more optical path lengths in the wavelength modulation device 532 itself (e.g., an interferometric system, such as in a Michelson, Fabry-Perot, or Sagnac interferometers). The spectral information may be derived from the resulting signal with a transform analysis like a Fourier transform or Hadamard transform, for example.

Please delete paragraph beginning at page 42, line 3 (see amendment received on February 26, 2007) beginning 'The system of Figure 5B...'

Please delete paragraph beginning at page 43, line 3 (see amendment received on February 26, 2007) beginning 'Fig. 5(f) is a diagrammatic ...'

Please replace the paragraph beginning at page 60, line 19 with the following paragraph:

In other combinational target arrangements, the imaging structures are laid out in the center of a symmetrically arranged set of scatterometry targets. Figure 11b is a top view representation of a second combination imaging and scatterometry target embodiment. As shown, scatterometry targets are symmetrically arranged around a central image type target [[152]] 1152. In this example, the image type target 1152 is formed from quadrants of line segments, where each quadrant is either in the x or y direction. Suitable image type targets and techniques for determining overlay with same are described in the following U.S. patents and applications: (1) Patent No. 6,462,818, issued 8 October 2002, entitled "OVERLAY ALIGNMENT MARK DESIGN" by Bareket, (2) Patent No. 6,023,338, issued 8 February 2000, entitled "OVERLAY ALIGNMENT MEASUREMENT OF WAFER", by Bareket, (3) Application No. 09/894,987, filed 27 June 2001, entitled "OVERLAY MARKS, METHODS OF OVERLAY MARK DESIGN AND METHODS OF OVERLAY MEASUREMENTS", by Ghinokver et al., and (4) Patent No. 6,486,954, issued 26 November 2002, entitled "OVERLAY ALIGNMENT MEASUREMENT MARK" by Levy et al. These patents and applications are all incorporated herein by reference in their entirety.

Please replace the paragraph beginning at page 74, line 3 with the following paragraph:

One advantage of the combined CDSEM and SCOL metrology system is the reduction in overall time required to complete scheduling and/or performing the CDSEM and scatterometry

overlay measurements. At least one queue delay time may be eliminated. Performing CDSEM and overlay measurements in parallel can save at least part of the time required for separate measurement operations. ~~Figure 10 is a diagrammatic top view representation of a system 1000 for obtaining a line image of a plurality of targets 1008a-1008d in accordance with one embodiment of the present invention. As shown, a light source 1002 directs a beam towards cylindrical optics 1004 configured to illuminate a one-dimensional (1D) incident line 1006 of the targets 1008a-1008d. The light source and the incident optics are arranged so that the 1D incident line strikes at least a portion of all of the four targets. For example, the 1D line is incident on a line through the center of the four targets.~~

Please delete paragraph beginning at page 79, line 6 (see amendment received on February 26, 2007) beginning 'In other combinational target arrangements...'

Please delete paragraph beginning at page 81, line 18 (see amendment received on February 26, 2007) beginning 'Additionally, imaging or scatterometry...'

Please delete paragraph beginning at page 85, line 8 (see amendment received on February 26, 2007) beginning 'The combination system 1160...'

Allowable Subject Matter

3. Claims 1-9, 34, 35, 40-42, 46, 47, 57-64, 89, 90, 95-97, and 101 are allowed.

The following is an examiner's statement of reasons for allowance:

As to **claims 1 and 57** the prior art of record, taken alone or in combination, fails to disclose or render obvious a method/system for determining overlay an optical apparatus comprising a spectroscopic normal incidence polarized differential reflectometer and an oblique incidence spectroscopic ellipsometer spectroscopic near-normal incidence polarized differential reflectometer and an oblique incidence spectroscopic ellipsometer, in combination with the rest of the limitations of **claims 1-9, 34, 35, 40-42, 46, 57-64, 89, 90, 95-97, and 101**.

As to **claim 47**, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method for determining overlay an optical apparatus comprising an imaging spectroscopic ellipsometer wherein only zeroth diffraction order is collected, in combination with the rest of the limitations of **claim 47**.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

4. Applicant's arguments, see Remarks page 12, filed July 27, 2007, with respect to the previous rejection of **claims 46, 58, 59, 101** under 35 U.S.C. 112 second paragraph and 35 U.S.C. 101 (see action: 20070511) have been fully considered and are persuasive. The previous rejection of **claims 46, 58, 59, 101** under 35 U.S.C. 112 second paragraph and 35 U.S.C. 101 has been withdrawn. Due to the amendment of **claims 1, 47, and 57** the previous rejection of the claims under 35 U.S.C. 103(a) has been withdrawn.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

- 1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and
- 2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by Fax transmission. Papers should be faxed to Group 2800 via the PTO Fax machine located in Crystal Plaza 4. The form of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The CP4 Fax Machine number is: (571) 273-8300

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (571) 272-2431.

The examiner can normally be reached on Monday-Friday, 8:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr., can be reached at 571-272-2800 ext 77.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 10/729,838

Page 10

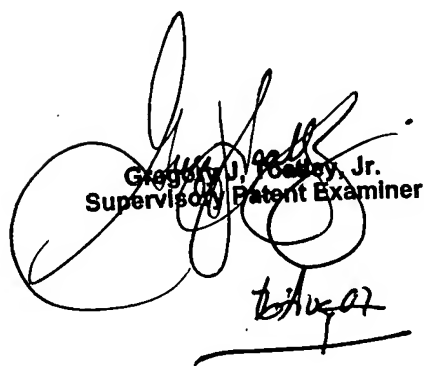
Art Unit: 2877

gs

gs

August 2, 2007

Gregory J. Toatley, Jr.
Supervisory Patent Examiner
Art Unit 2877


Gregory J. Toatley, Jr.
Supervisory Patent Examiner
8/2/07

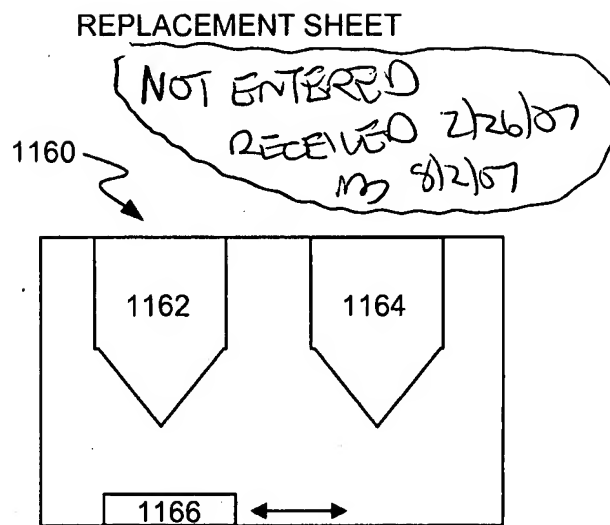


Fig. 11d

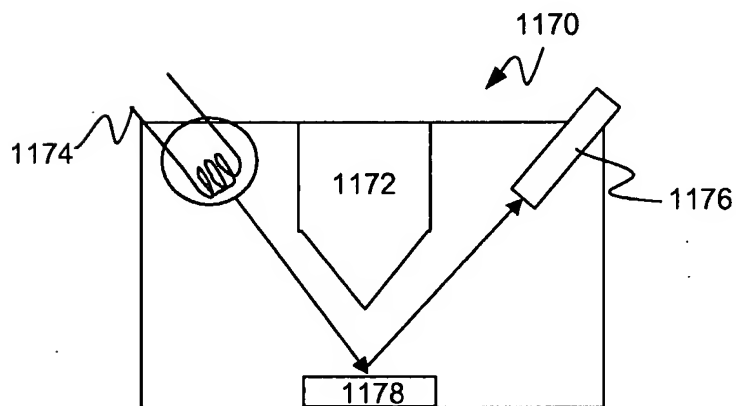


Fig. 11e

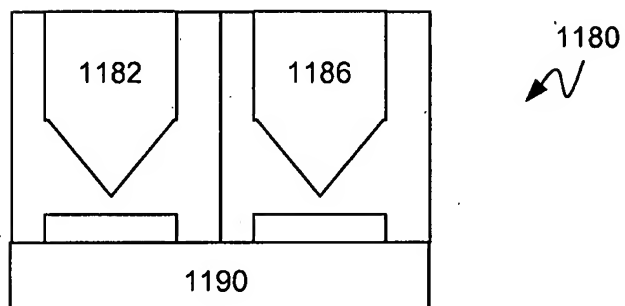


Fig. 11f